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IMPACT OF TECHNICAL INTERVENTIONS ON BIOLOGICAL AND ECONOMIC PERFORMANCE OF CATTLE AND BUFFALOES IN CROP-DAIRY ANIMAL PRODUCTION SYSTEM IN NILE DELTA

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SUMMARY

The aim of this study was to evaluate the impact of livestock technical interventions, through Food Sector Development Program (FSDP), on crop-dairy production system in the Nile delta of Egypt. Forty-five extension packages in seven categories were developed, tested and disseminated in various target areas. Data on 492 crop-dairy farms were collected through a survey as a part of FSDP activities to assess the impact of these interventions. Each farmer was interviewed twice, once during 1993 to 1997 (before implementation) and another during 1998 to 2001 (after implementation). Data included only farmers who kept cropping land plus buffalo and / or dairy cattle in five different governorates, Damietta (DAM), Kafr El-Sheikh (KEl), Menoufeia (MEN), Daqahleia (DAQ) and Gharbeia (GHA). Two districts were sampled within each governorate, one had farmers collaborating with FSDP who got at least one package (C_1) and the other non-collaborating farmers (did not receive any package (control group)). Cattle were of three genotypes, native, exotic and cross between them. Response indicators considered were daily milk yield (DMY), weaning mortality rate (WMR), farm size (FS) and herd size (HS) while the economic indicators were internal rate of return (IRR), return per feddan (RPF) and return per animal (RPA). Three statistical models were applied for evaluating the impact of interventions on the response indicators. The program had favorable impact on all indicators considered. Results showed that MEN showed the highest FSDP impact on DMY and highest average DMY for buffalo and native and crossbred cattle while DAM was the highest in exotic cattle. Also, the interventions had significant ($p<0.05$) favorable effect on WMR in all genotypes. MEN registered the lowest mean and impact on FS and HS while DAQ had the highest estimates for both. DAQ, DAM and MEN scored the highest IRR, RPF and RPA, respectively. Governorates responded differently to the program and so did types of animals. Proportional to their initial DMY, buffalo and native cows increased more than crossbreds and exotic cows, percentage of increase, being 22, 32, 12 and 13, respectively, indicating the relatively unutilized potential of local buffalo and cattle.

Keywords: Crop-dairy production system, daily milk yield, IRR, technical interventions

INTRODUCTION

In Egypt, the crop-dairy animal production system is one of the most important livestock production systems. This system is widespread in different regions as Nile delta, newly reclaimed lands and Upper Egypt. It is the main milk source, providing 90% of the total milk production (Abdel-Aziz, 1997). An estimated 85% of the total domestic milk output is provided by traditional farms mainly in this system while 15% is provided by the commercial sector (MoALR, 2004).

Food Sector Development Program (FSDP), which is considered in the present study, lasted from 1991 to 2001 and was funded by the European Commission (EC) for a value of 9.9 million Euro. FSDP activities aimed at servicing the dairy sector and focused on the production, processing and marketing of milk. Also, it included technical components, which support the development of the dairy sector. FSDP activities were institution building, training and demonstration, technical assistance and a 75 million Euro fund as credit and guarantee scheme that lasted from 1993 to 2001. Target group was the small and medium scale farmers. The aim of this study was to evaluate the impact of interventions through FSDP on crop-dairy animal production system in the Nile delta.

MATERIAL AND METHODS

Data:

Data on 492 crop-dairy farms were collected between 1993 and 2001 through a survey as a part of the FSDP project. Recruitment of collaborating farms extended from 1993 to 1997 while measuring the impact of the project extended from 1998 to 2001. The data were collected only from farmers with cropping activities and had kept one or more of buffaloes and/or dairy, Native (Baladi), exotic and/or crossbred cows. Exotics were mainly Holstein and Friesian. Each farm had two interviews, one at the beginning of the study during 1993 to 1997 and another at the end of the study during 1998 to 2001. Data were collected from five different governorates in the Nile Delta, Damietta (DAM), Kafr-El-Sheikh (KEl), Menoufeia (MEN), Daqahleia (DAQ) and Gharbeia (GHA). Two districts were sampled from each governorate, one had collaborating (C_1) farmers and the other non-collaborating (C_0) farmers. Collaborating farmers would get at least one of the project training packages while non-collaborating farmers received no such training packages (as a control group). Table 1 shows the distribution of farmers.

Interventions:

Forty-five extension packages in seven categories were developed, tested, and disseminated in various target areas. These were 17 in feed and feeding, 2 each in breeding and management, animal housing, and calf rearing, 10 in milk processing and marketing, 3 in animal health and AI, and 9 in the investment packages. Different packages had different degrees of adoption in various target areas.

Biological indicators:

Biological indicators were daily milk yield (DMY) defined as the average daily milk yield per animal and weaning mortality rate (WMR) as percentage of calf mortality from birth to weaning at an average of 4 months of age.

Table 1. Number of farmers in the two different districts within each of the five studied governorates

Governorate	District	No. of farmers	Total
Damietta			73
	C_0 -Kafr Saad	26	
	C_1 - Faraskur	47	
Kafr-El-Sheikh			87
	C_0 -Dessouk	8	
	C_1 –Qallin	79	
Menoufeia			125
	C_0 -Ashmoun	31	
	C_1 -Shanshour	94	
Daqahleia			103
	C_0 -Sherbeen	12	
	C_1 -Senbllewien	91	
Gharbeia			104
	C_0 –Tanta	20	
	C_1 –Quttur	84	
Total			492
	C_0	97	
	C_1	395	

C_0= non-collaborating district C_1= collaborating district

Physical indicators:

Physical indicators were farm size (FS) defined as the cropping land area per farm and herd size (HS) as the number of large ruminants per farm.

Economic indicators:

Three economic indicators were considered. The first was the internal rate of return (IRR) defined as the rate of return that would be achieved on all project resource costs, where all benefits and costs are measured in economic prices and calculated as the rate of discount for which the present value of the net benefit stream becomes zero, or at which the present value of the benefit stream is equal to the present value of the cost stream at interest rate of 10%. The second and third economic indicators considered were return per feddan (RPF) defined as the gross margin divided by the cropping area in of feddans, and the return per animal (RPA) defined as the gross margin divided by number of large ruminants. More details are provided by Rashwan (2006).

Statistical analyses

Data were analyzed using SAS for Windows (1998). Three models used to study different factors potentially affecting DMY, WMR, FS, HS, IRR, RPF and RPA are described below. Data for WMR, recorded in the questionnaire as percentages, were transformed using arcsine transformation and means and SE presented in the tables are decoded to the original scale. Model I aiming at a preliminary evaluation of the program impact, expressed as after FSDP minus before FSDP separately for C_1 and C_0 farms, included governorate and farm within district within governorate (as the model error). Model II was as Model I plus the effect of year where C_0 and C_1 farms were separately analyzed. Model II helps to test any time trend within each of collaborating and non-collaborating farms to discount this time trend, if any, from the project impact. Model III was run for C_1 only to study the effects of the year within status, the status being before/after the program activities, governorate, and farm within district within governorate (considered as the first error to be used for testing the preceding effects). Details of these models are shown below.

Model I

$$Y_{klm} = \mu + G_k + F_{m(kl)}$$

where,

Y_{klm} = the observation on the m^{th} farm, within the l^{th} district, within the k^{th} governorate, expressed as after program minus the same farm before program;

μ = overall mean;

G_k = the effect of governorate, k =1,…5; and

$F_{m(kl)}$ = the effect of farm within district, m =1,…20 (farms having more than one genotype were repeated in the analysis as the number of incidence of the genotypes). The farm was considered as the model error, assumed to be normally and independently distributed with mean 0 and variance σ^2_F.

C_0 and C_1 farms were separately analyzed. Since not all farms had their initial visits and their final visits in the same years, inclusion of year in Model I resulted in non-connectedness in the data which led to singular matrixes not allowing the completion of the analyses. That means that estimates of program impact from Model I could be confounded with year effects and possibly interacting with it. Naturally, districts were not included in Model I because one district in the governorate benefited from program inputs and the other did not. Thus, if there were genuine differences between districts within governorate, this would confound the impact of the program. There was no way that the two effects i.e. program impact and district could be completely separated. The following models were assumed to discern year effect and district effect and try to deduce a "cleaner" estimate of program impact. In this model, in C_1, "after-before" = program impact + 'other' effects, while in C_0 it is only the 'other' effects.

Model II

$$Y_{iklm} = \mu + T_i + G_k + F_{m(kl)} + e_{iklm}$$

where,

Y_{iklm} = the observation after or before on the m^{th} farm, within the l^{th} district, within the k^{th} governorate in the i^{th} year, regardless whether the farm had received intervention, i.e. all farms were included;

μ = overall mean;

T_i = the effect of year, i =1,..9;

G_k = the effect of governorate, k =1,…5;

$F_{m(kl)}$ = the effect of farm within district, m =1,…20 (farms having more than one genotype were repeated in the analysis as the number of incidence of the genotypes). The farm was considered as the model first error, assumed to be normally and independently distributed with mean 0 and variance σ^2_F; and

e_{iklm} = the residual assumed to be normally and independently distributed with mean 0 and variance σ^2_e.

C_0 and C_1 farms were separately analyzed.

Model III

$$Y_{ijklm} = \mu + T_{i(j)} + P_j + G_k + F_{m(kl)} + e_{ijklm}$$

where,

Y_{ijklm} = the observation on the mth farm, within the lth district, within the kth governorate in the ith year within status, i.e. in receipt or non-receipt of interventions;

μ = overall mean;

$T_{i(j)}$= the effect of year within status, i =1,..9;

P_j = status (before/after), j = before or after;

G_k = the effect of governorate, k =1,…5;

$F_{m(kl)}$ = the effect of farm within district, m =1,…20 (farms having more than one genotype were repeated in the analysis as the number of incidence of the genotypes). The farm was considered as the model first error, assumed to be normally and independently distributed with mean 0 and variance σ^2_F; and

e_{ijklm} = the residual assumed to be normally and independently distributed with mean 0 and variance σ^2_e.

This analysis was done for collaborating districts (C_1) only.

RESULTS AND DISCUSSION

Program impact on biological indicators

Daily milk yield:

As a preliminary evaluation of the program impact, t test of significance was made for the difference between general means of C_1 and C_0 categories for the after minus before situations (Model I). Results indicated that a significant program impact ($p<0.05$) was shown only on milk production of crossbred cattle (Table 2). Generally, DMY increased more in C_1 than C_0, the increase being 2.56, 1.97, 1.98 and 1.66 kg for buffalo, native, crossbred, and exotic cattle, respectively in C_1 and 1.03, 0.22, 0.96 and 0.66 kg, respectively in C_0. According to Model I results, governorate highly significantly ($p<0.01$) affected impact-change in DMY in all genotypes in C_1 but the change was only significant ($p<0.05$) in C_0 as shown in Tables 2 and 3. Variation among governorates (i.e. mean squares) was always higher for C_1 than C_0 for buffalo and all cattle types (Table 2), indicating that governorates responded differently to the program activities. MEN showed the highest impact for buffalo and native cattle in both C_1 and C_0, but DAM, being a dairy governorate, showed the highest impact for the exotic cattle. The high DMY from exotic cattle and the high program impact in DAM might be due to the greater interest in milk processing which makes producers in this governerate follow a different production strategy. The program had positive impact on DMY in all genotypes, but this impact was higher in buffalo and native than in crossbred and exotic, 1.53 and 1.75 kg vs. 1.02 and 1.00 kg, respectively. This result could be due to that, the program paid more attention to developing the production from buffalo and native cattle or that farmers with crossbred and exotics are more progressive producers who had already been applying some interventions and the interventions by the program led to less differential to them than to farmers with buffaloes and native cattle.

In Model II results showed that generally, year had highly significant effect ($p<0.01$) on DMY for the C_1 (that might indicate some of the impact of the program) and only significant effect ($p<0.05$) for the C_0 in all genotypes. Despite this significant or highly significant effect, year effect showed generally increasing trends in C_1 but no specific trend in C_0 (Table 3).

Model III results showed that, for C_1 only, effects of year within status, governorates, status and farm within district within governorate were all significant in buffalo and all cattle genotypes, except the governorate effect in native cattle (Table 4). The impact of the program, i.e. after minus before (Table 4) on DMY was positive 1.8 kg (22%), 1.2 kg (32%), 1.0 kg (12%) and 2.0 kg (13%) for buffalo, native, crossbred, and exotic cattle, respectively. Table 4 shows that earlier years in both before and after had lesser average DMY than later ones with some of earlier years significantly lesser than later ones.

Table 4. Least squares means of daily milk yield (DMNY, kg) in buffalo and other cattle genotypes (Model III)[1,2]

	Buffalo			Native			Crossbred			Exotic		
Source of	No.	LSM	±SE	No.	LSM	±SE	No.	LSM	±SE	No.	LSM	±SE
General		8.9			4.2			8.6			16.7	
Year (status)		5.3*			3.9**			2.7*			7.5*	
Year(before)												
1993	38	7.2 b	0.83	38	2.9 b	1.04	39	7.7 b	1.07	44	14.9 b	2.18
1994	83	8.0 a	1.09	83	3.4 a	1.1	53	8.2 a	1.3	52	15.8 b	2.33
1995	69	8.1 a	1.09	69	3.7 a	1.01	105	8.1 a	0.83	110	16.3 a	1.93
1996	59	8.3 a	1.28	59	3.7 a	1.04	53	8.8 a	1.32	50	16.3 a	2.41
1997	43	8.6 a	1.27	43	3.8 a	0.92	21	8.8 a	1.61	21	16.7 a	2.66
Year(after)												
1998	80	9.5 b	1.65	80	3.9 b	0.96	57	8.9 a	0.87	57	17.2 ab	1.92
1999	86	9.9 b	1.66	86	4.8 a	0.88	94	8.9 a	0.9	94	17.8 a	2.42
2000	75	10.5 a	1.13	75	5.0 a	0.78	73	9.3 a	0.94	79	18.1 a	2.08
2001	51	10.5 a	1.57	51	5.3 a	0.98	47	9.4 a	0.96	47	18.3 a	2.81
Status		368.4**			368.4**			66.3**			36.1**	
Before	292	8.1 a	0.07	292	3.7 a	0.06	271	8.3 a	0.05	277	15.6 a	0.59
After	292	9.9 b	0.07	292	4.9 b	0.06	271	9.1 b	0.05	277	16.6 b	0.58
Governorate		48.8**			48.8**			71.0**			325.0**	
DAM	44	7.6 e	0.17	44	3.7 c	0.14	33	8.2 c	0.14	32	19.0 a	0.33
KEL	84	9.1 b	0.17	84	4.3 ab	0.14	71	8.8 b	0.13	55	16.2 c	0.21
MEN	84	9.6 a	0.17	84	4.4 a	0.08	82	9.9 a	0.08	83	18.5 b	0.66
DAQ	15	9.4 a	0.15	15	4.2 b	0.13	38	8.2 c	0.12	47	15.3 e	0.11
GHA	65	8.6 c	0.11	65	4.3 ab	0.09	47	7.8 e	0.09	60	14.7 e	0.89
F(D (G))	2.7 (287) df			1.3 (283) df			0.76 (266) df			2.8 (322) df		

1. Figures across source of variations are their respective mean squares.
2. Means within columns followed by different scripts differ from each other ($P<0.05$).
3. Total number of observation for years is twice that for governorate since each farm was represented twice, once before and once more after.

* $P<0.05$ ** $P<0.01$

F(D(G)) = Farm within district within governorate MS df degrees of freedom

C_0= non-collaborating district C_1= collaborating district

Weaning mortality rate

In all models, in C_1, DAQ governorate showed the highest estimates for the WMR in all genotypes, being 4.4%, 3.9%, 4.2% and 5.2% for buffalo, native, crossbred and exotic, respectively, while DAM governorate scored the lowest, 1.2%, 1%, 1.3% and 2.9%, respectively. Program showed significant favorable effect on WMR in all genotypes indicated that the training packages and other technical support activities concerning animal health, improving feeds, calf rearing and better animal housing improved WMR.

Program impact on farm size (FS) and heard size (HS)

In all models, MEN registered the lowest mean of FS (3.8 feddans and 2.8 feddans in C_1 and C_0, respectively) and HS (2.5 animals and 1.7 animals in C_1 and C_0, respectively). While DAQ registered the highest estimates for both (6.8 feddans and 3.7 feddans in C_1 and C_0, respectively, and 2.7 animals and 2.1 animals in C_1 and C_0, respectively), The program had positive significant ($p<0.05$) effect on both FS and HS. In general, the average FS and HS was 3.9 feddans and 1.6 animals in C_1 before project impact and 4.6 feddans and 2.6 animals in C_0, respectively, after project impact.

Program impact on economic indicators

In Model I, governorate showed significant effects on all the economic indicators in C_1 and C_0 except IRR in C_0, which was non-significant (Table 5). Higher level of significance ($p<0.01$) was detected in C_1 than C_0 ($p<0.05$) for RPF and RPA indicating that governorates responded differently to the program activities. Estimates of IRR, RPF, and RPA for all governorates were always higher in C_1 than C_0, (Table 5). The highest IRR percentages were scored for DAQ governorate in C_1 and DAM governorate in C_0, while the lowest governorate was MEN in both C_1 and C_0. DAM was the highest governorate in RPF in both C_1 and C_0, while the lowest governorates were GHA in C_1 and KEL in C_0. MEN was the highest governorate in RPA in both C_1 and C_0, while the lowest governorates were KEL in C_1 and DAQ in C_0.

In Model II, results showed that both year and governorate had significant effects ($p<0.05$) on IRR, RPF and RPA for the C_1 only. Although year showed such significant effect, there was no specific trend in their effect (Table 6). DAQ, DAM, and MEN, respectively, recorded the highest IRR, RPF and RPA, while KEL and GHA recorded the lowest.

Model III results showed that although year within status had a positive increasing trend over years, this trend was non-significant in all of the economic indicators (Table 7). Governorate had a significant effect ($p<0.01$) on IRR, RPF, and RPA. Status showed highly significant effect ($p<0.01$) on all the studied economic indicators (Table 7). The impact of the program on IRR, RPF, and RPA was favorable, 0.07 (1%), LE 51.2 (28%), and LE 94.8 (40%), respectively. Years results show that earlier years in both before and after on the average had less IRR, RPF, and RPA than later ones.

Table 7. Least squares means (LSM) IRR, RPF and RPA (Model III) [1,2]

Source of variation	IRR, %			RPF, LE			RPA, LE		
	No.	LSM	±SE	No.	LSM	±SE	No.	LSM	±SE
General mean		0.71			277			289	
Year (status)		0.04^{ns}			137^{ns}			160^{ns}	
Year (before)									
1993	48	0.64 a	0.12	48	176 a	51.2	48	217 a	79
1994	94	0.66 a	0.2	94	177 a	58.1	94	222 a	60.7
1995	109	0.69 a	0.19	109	179 a	41.6	109	232 a	109.6
1996	78	0.69 a	0.16	78	189 a	44.1	78	241 a	116
1997	67	0.70 a	0.2	67	189 a	44.6	67	277 a	59.6
Year (after)									
1998	96	0.73 a	0.21	96	218 a	95	96	324 a	89.1
1999	123	0.74 a	0.22	123	227 a	116.8	123	329 a	74.8
2000	98	0.75 a	0.21	98	254 a	64.2	98	343 a	73.4
2001	79	0.80 a	0.16	79	354 a	58.5	79	375 a	77.2
Status		0.73^{**}			560^{**}			846^{**}	
Before	396	0.67 a	0.04	396	182 a	0.26	396	235 a	0.63
After	396	0.74 b	0.04	396	333 b	0.25	396	329 b	0.62
Governorate		0.01^{**}			516^{**}			517^{**}	
DAM	52	0.69 b	0.1	52	294 a	0.96	52	280 a	0.52
KEL	87	0.67 b	0.11	87	263 a	0.64	87	283 a	0.12
MEN	94	0.73 a	0.06	94	289 a	0.4	94	298 a	0.51
DAQ	74	0.77 a	0.1	74	265 a	0.42	74	288 a	0.54
GHA	89	0.72 a	0.07	89	273 a	0.53	89	296 a	0.5
F(D (G))	$0.07\ (391)^{df}$			$77\ (391)^{df}$			$83(391)^{df}$		

1. Figures across source of variations are their respective mean squares.
2. Means within columns followed by different scripts differ from each other (P<0.05).
3. Total number of observation for years is twice that for governorate since each farm was represented twice,
once before and once more after.

** P<0.01 ns P<0.05

F(D(G)) = Farm within district within governorate mean squares

df= degrees of freedom

C_0= non-collaborating district C_1= collaborating district

CONCLUSION

FSDP had positive impact on biological, physical and economic indicators. Degree of impact differed among governorates where MEN reported the highest program impact on DMY and highest average for buffalo, native and crossbred while

DAM was the highest in exotic DMY. FSDP as well as other studied factors, showed significant effects on weaning mortality rate, in all genotypes and positively improved both farm and herd size. Earlier years in both before and after had less average DMY, FS and HS than later ones. Collaborating districts showed significant difference from the non-collaborating ones in all economic indicators except the IRR in MEN and DAQ and the RPF in GHA.

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أثر المستحدثات التقنية على الأداء البيولوجي و الاقتصادي للأبقار والجاموس تحت منظومة الإنتاج النباتي- الحيوانات الحلابة في منطقة دلتا النيل

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هدفت هذه الدراسة إلى تقييم أثر المستحدثات التقنية المقدمة من خلال برنامج إنماء قطاع الغذاء علي تطوير منظومة الإنتاج النباتي – الحيوانات الحلابة في منطقة دلتا النيل. تم إعداد و إختبار و نشر 45 حزمة فنية في7 أقسام في عدد من المناطق المستهدفة. جمعت البيانات الخاصة بالإنتاج النباتي و الحيواني لـ 492 مزرعة مختلطة و ذلك في صورة إستبيان من خلال أنشطة برنامج إنماء قطاع الغذاء . أجريت مقابلتان مع كل مزارع إحداهما في بداية الدراسة خلال الفترة من 1993 الى1997 (قبل تقديم الحزم) و الأخرى فى نهايتها خلال الفترة 1998 إلى 2001 (بعد تقديم الحزم). تضمن الإستبيان البيانات الخاصة فقط بالمزارعين الحائزين لأرض زراعية و حيوانات حلابة من الجاموس و/أو الأبقار و ذلك في خمسة من محافظات الدلتا و هي دمياط، كفر الشيخ، المنوفية، الدقهلية و الغربية. أختير مركزان على مستوى كل محافظة، أحدهما به مزارعون متعاونون مع المشروع و الآخر به مزارعون غير متعاونين. أعتبر المزارعون المتعاونون هم أولئك الذين حصلوا على حزمة تدريبية واحدة على الأقل في حين لم يحصل المزارعون غير المتعاونين على مثل هذا التدريب (مجموعة مقارنة). مؤشرات الإستجابة للحزم المقدمة هي محصول اللبن اليومي، معدل النفوق حتى الفطام، المساحة المحصولية و حجم القطيع، في حين أعتبر كلا من معدل العائد الداخلي، العائد للفدان و العائد للحيوان مؤشرات إقتصادية. المراكز المتعاونة هى فارسكور، قللين، شنشور، السنبلاوين و قطور فى حين كانت المراكز غير المتعاونة هى كفر سعد ، دسوق، أشمون، شربين و طنطا لمحافظات دمياط ، كفر الشيخ، المنوفية، الدقهلية و الغربية على الترتيب. أستخدم ثلاث نماذج احصائية لتقييم أثر الحزم على مؤشرات الإستجابة. كان للمشروع أثر إيجابي علي المؤشرات موضع الدراسة. أظهرت محافظة المنوفية أعلى أثر للبرنامج على محصول اللبن اليومي و أعلى متوسط لهذه للصفة فى كلٌ من الجاموس و الأبقار البلدية والأبقار الخليطة في حين حققت محافظة دمياط أعلى متوسط لبن يومي فى الأبقار الأجنبية. أحدثت الحزم المقدمة انخفاضا معنويا في معدل النفوق حتي الفطام في جميع التراكيب الوراثية المدروسة. سجلت المنوفية أقل متوسط و أقل أثر للمشروع على المساحة المحصولية و حجم القطيع في حين سجلت الدقهلية أعلى تقدير لهما. سجلت محافظات الدقهلية ، دمياط و المنوفية أعلى نسبة معدل للعائد الداخلى و العائد للفدان و العائد من الحيوان، على الترتيب. إختلفت إستجابات المحافظات المختلفة لأنشطة البرنامج و كذلك إختلفت التراكيب الوراثية للحيوانات الحلابة في إستجابتها. فقد سجلت محافظة المنوفية أعلى أثر للبرنامج على صفة محصول اللبن اليومي و أعلى متوسط لنفس الصفة لكل التراكيب الوراثية الحيوانية موضع الدراسة عدا الأبقار الحلابة الأجنبية حيث حققت محافظة دمياط أعلى متوسط إنتاجي لها و ليس أعلى أثر للبرنامج. و نسبيا لمحصول اللبن اليومي البدائي، فقد حقق الجاموس و الأبقار البلدية معدل تحسين إنتاجي يفوق مثيله في الأبقار الخليطة و الأجنبية حيث بلغت نسب التحسين 22 و 32 و 12 و 13 % على الترتيب. مما يشير إلى عدم الإستغلال الأمثل للقدرات الإنتاجية الكامنة في الحيوانات المحلية من الجاموس و الأبقار.

Table 2. Least squares means (LSM) and standard errors (±SE) for the impact on daily milk yield (kg) (after- before) in buffalo and other cattle genotypes in C_1 and C_0 (Model I)[1,2]

Source of variation	Buffalo				Native				Crossbred				Exotic			
	C_1		C_0		C_1		C_0		C_1		C_0		C_1		C_0	
	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM
Governorate		33.3**		1.5*		8.7**		2.5*		19.1**		0.18*		2.1**		0.32*
General mean		2.56		1.03		1.97		0.22		1.98		0.96		1.66		0.66
DAM	44	2.01*bc	18	0.84*c	38	1.54*c	18	0.11^{ns}c	38	1.71*b	18	1.21*a	32	1.92*a	9	0.75*a
KEL	84	2.22*b	10	0.93*b	84	1.72*bc	10	0.22^{ns}b	80	2.32*a	10	1.31*ab	85	1.63*b	6	0.70*b
MEN	84	3.72*a	22	1.82*a	85	2.74*a	22	0.43^{ns}a	81	2.82*a	19	0.94*a	55	1.82*a	17	0.50^{ns} d
DAQ	15	2.42*b	4	0.92^{ns}b	15	1.73*bc	3	0.22^{ns}b	13	1.74*b	4	1.03*ab	47	1.51* bc	11	0.62*c
GHA	65	2.42*b	16	0.63^{ns}c	66	2.13*b	14	0.11^{ns}c	59	1.31*b	10	0.62*c	70	1.43*c	13	0.74*ab
F(D(G))		0.85 (287)^{df}		0.49 (69)^{df}		0.34 (283)^{df}		0.99 (62)^{df}		0.46 (266)^{df}		0.06 (56)^{df}		0.03 (322)^{df}		0.10 (50)^{df}

1. Figures across source of variations are their respective mean squares.
2. Means within columns followed by different scripts differ from each other ($P<0.05$).
* Estimate is different from zero, or source of variation has a significant effect ($P<0.05$)
** Estimate is different from zero, or source of variation has a highly significant effect ($P<0.01$)
ns Estimate is not different from zero, or source of variation is not significant
F(D(G)) = Farm within district within governorate mean squares df degrees of freedom

Table 3. Least squares means (LSM) and standard errors (±SE) for daily milk yield (kg) in buffalo and other cattle genotypes in C_1 and C_0 (Model II) [1,2,3]

Source of variation	Buffalo				Native				Crossbred				Exotic			
	C_1		C_0		C_1		C_0		C_1		C_0		C_1		C_0	
	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM
General mean		8.9		7.6		4.4		3.4		8.5		7.7		16.7		15.5
Year		6.29^{**}		2.55^{*}		3.78^{**}		2.76^{*}		2.58^{**}		5.41^{*}		21.58^{**}		6.85^{*}
1993	38	8.8e	12	7.8 a	39	3.8b	14	4.7 a	39	8.0 b	7	8.4a	44	16.3b	7	15.3b
1994	83	7.6 f	25	7.6 a	53	3.8b	15	4.8 a	53	8.5ab	15	8.5a	52	17.1a	13	17.1a
1995	69	8.7e	13	7.7 a	115	4.0 b	23	3.8 b	105	8.5ab	22	8.3b	110	16.8a	18	16.8a
1996	59	8.7e	11	7.7 a	64	4.0 b	9	3.8 b	53	8.5ab	12	8.7a	50	16.6a	12	16.6a
1997	43	9.2e	9	7.2 b	17	4.4 a	6	4.4 a	21	8.7a	5	8.9a	21	16.7ab	5	16.7a
1998	80	9.6b	23	7.6 a	67	4.4 a	13	4.7 a	57	8.8a	11	8.4a	57	16.8ab	8	16.8a
1999	86	9.5c	21	7.5 b	95	4.5 a	22	4.0 b	94	8.8a	25	8.8a	94	17.4b	22	15.4b
2000	75	9.9a	16	7.9a	76	4.7 a	21	4.7 a	73	8.9a	15	8.2b	79	18.4 a	15	17.4a
2001	51	9.7a	10	8.0a	50	4.8 a	11	4.4 a	47	8.9a	10	8.2b	47	19.3 a	10	15.3b
Governorate		11.23^{**}		4.23^{*}		5.86^{**}		3.22^{*}		7.37^{**}		4.66^{*}		14.23^{**}		7.52^{*}
DAM	44	7.6e	18	7.6d	44	4.4 b	18	3.4 b	33	8.2c	18	7.2c	32	19.0 a	17	17.2 a
KEL	84	9.3b	10	7.3 b	56	4.4 b	10	3.4 b	71	8.7b	10	7.7b	55	18.3 c	13	16.3 b
MEN	84	9.5a	22	8.1a	84	4.7 a	22	3.7 a	82	9.8a	19	8.8a	83	16.2b	6	16.2 b
DAQ	15	9.4 a	4	7.5a	25	4.2 c	3	3.2 c	38	8.2c	4	7.2c	47	15.3e	10	14.3e
GHA	65	8.7c	16	7.7c	79	4.5 ab	14	3.5 ab	47	7.8d	10	7.8b	60	14.7e	9	13.7e
F(D (G))	$2.33\ (287)^{df}$		$1.21\ (69)^{df}$		$0.34\ (283)^{df}$		$1.05\ (62)^{df}$		$0.62\ (266)^{df}$		$1.74\ (56)^{df}$		$3.54\ (322)^{df}$		$2.40\ (50)^{df}$	

1. Figures across source of variations are their respective mean squares. 2. Means within columns followed by different scripts differ from each other ($P<0.05$).
3. Total number of observation for years is twice that for governorate since each farm was represented twice, once before & once after.
* $P < 0.05$ ** $P < 0.01$ F(D(G)) = Farm within district within governorate mean squares df = degrees of freedom

Table 5. Least squares means (LSM) for the impact (after-before) on IRR (%), RPF and RPA (LE) in C_1 and C_0 (Model I) [1,2]

Source of variation	IRR, %				RPF, LE				RPA, LE			
	C_1		C_0		C_1		C_0		C_1		C_0	
	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM	No.	LSM
General mean		0.18		0.02		223		219		321		139
Governorate		0.07^{**}		0.005^{ns}		257.9^{**}		113.9^{*}		223.6^{**}		105.1^{*}
DAM	52	0.19^{*}b	18	0.03^{ns} a	52	302^{*}a	18	222^{ns}a	52	310^{*}b	18	120^{ns}a
KEL	87	0.15^{*}c	10	0.02^{ns} b	87	294^{*}a	10	217^{ns}a	87	308^{*}b	10	166^{ns}a
MEN	106	0.13^{*}c	33	0.01^{ns} c	106	297^{*}a	33	220^{ns}a	106	352^{*}a	33	172^{ns}a
DAQ	69	0.23^{*}a	14	0.02^{ns} b	69	283^{*}a	14	220^{ns}a	69	320^{*}ab	14	117^{ns}a
GHA	90	0.20^{*}b	21	0.02^{ns} b	90	260^{*}ab	21	219^{ns}a	90	316^{*}ab	21	121^{ns}a
F(D (G))		$0.007\ (391)^{df}$		$0.007\ (50)^{df}$		$73.6(391)^{df}$		$39.0(91)^{df}$		$60.4\ (391)^{df}$		$34.4\ (91)^{df}$
±SE		0.06 to 0.11		0.01 to 0.20		0.40 to 0.96		45.00 to 124.40		0.12 to 0.54		28.00 to 41.00

1. Figures across source of variations are their respective mean squares.
2. Means within columns followed by different scripts differ from each other ($P<0.05$).

ns Estimate is not significantly different from zero. * Estimate is significantly different from zero, or source of variation has a significant effect ($P<0.05$).

** Source of variation has a highly significant effect ($P<0.01$).

df = degrees of freedom

F(D(G)) = Farm within district within governorate mean squares.

C_0= non-collaborating district C_1= collaborating district

SE = range of standard error for governorate means in kg.

Table 6. Least squares means (LSM) 0f IRR (%), RPF and RPA (LE) in C_1 and C_0 (Model II)[1,2]

Source of variation	C_1				C_0			
	No.	LSM			No.	LSM		
		IRR%	RPF, LE	RPA, LE		IRR%	RPF, LE	RPA,LE
General mean		0.72	274	328		0.062	284	328
Year		1.72^{*}	832^{*}	814^{*}		0.07^{ns}	740^{ns}	814^{*}
1993	48	0.84 a	273 bc	244 b	17	0.74 a	266 ab	244 b
1994	94	0.80 a	260 c	255 ab	24	0.70 a	252 b	255 ab
1995	109	0.74 ab	292 ab	262 ab	28	0.64 ab	281 a	262 ab
1996	78	0.73 a	294 bc	289 a	18	0.63 ab	283 a	289 a
1997	67	0.72 a	293 ab	302 a	9	0.62 ab	272 a	302 a
1998	96	0.71 b	298 ab	259 ab	21	0.61 ab	271 a	259 ab
1999	123	0.70 b	295 a	263 ab	32	0.60 b	270 a	263 ab
2000	98	0.79 a	283 ab	243 b	24	0.69 a	269 a	243 b
2001	79	0.79 a	282 ab	252 ab	19	0.69 a	263 ab	252 ab
Governorate		1.09^{*}	954^{*}	941^{*}		0.02^{ns}	384^{ns}	941^{*}
DAM	52	0.76 a	299 a	300 b	18	0.60 c	295 a	300 b
KEL	87	0.65 b	255 b	344 a	10	0.58 d	275 b	344 a
MEN	94	0.68 b	264 b	359 a	33	0.62 b	289 ab	359 a
DAQ	74	0.77 a	279 b	334 a	14	0.68 a	279 b	334 a
GHA	89	0.72 a	274 b	306 b	21	0.62 b	285 ab	306 b
F(D(G))	391	0.67	377	376	91	0.57	905	828
±SE		0.06 to 0.11	0.40 to 0.96	0.40 to 0.96		0.01 to 0.20	0.12 to 0.63	0.12 to 0.63

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2. Means within columns followed by different scripts differ from each other ($P<0.05$).
3. Total number of observation for years is twice that for governorate since each farm was represented twice, once before and once after.
* $P<0.05$ ns $P\geq0.05$
F(D(G)) = Farm within district within governorate mean squares
df= degrees of freedom
C_0= non-collaborating district C_1= collaborating district
SE = range of standard error for governorate means in kg.